

Evidence for the Formation of Large-Scale Current Sheets in Three Solar Flares

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We present X-ray evidence for the formation of large-scale current sheets in three flares observed by the Ramaty High Energy Solar Spectroscopic Imager (RHESSI) on 2002 April 14, 15 and 16 in NOAA region 9901 at the northwest limb. RHESSI images show clear flare loops and a separate coronal source above these loops in all three flares. The height of the loops decreased in the first few minutes during the impulsive rise in hard X-ray (>25 keV), then increased with time. We will focus on the event on April 15. The RHESSI images show a cusp-shaped flare loop in the rise phase. When the impulsive rise in hard X-rays began, the cusp part of the coronal source separated from the underlying flare loop and remained stationary for about 2 minutes. During this time the underlying flare loops shrank at 9 km/s. The temperature of the underlying loops increased towards higher altitudes, while the temperature of the coronal source increased towards lower altitudes. These results suggest that a current sheet formed between the top of the flare loops and the coronal source during the early impulsive phase. After the hard X-ray peak, the loop source moved outward at ~ 8 km/s and the coronal source moved outward at ~ 300 km/s, suggesting an upward motion and an elongation of the current sheet. About 30 minutes later, post-flare loops seen with the SOHO Extreme Ultraviolet Imaging Telescope 195 passband rose at ~ 10 km/s. A large coronal loop-like structure, observed by the SOHO Large Angle and Spectrometric Coronagraph C2 and C3 detectors, also propagated outward at ~ 300 km/s. These observations are all consistent with the continued elongation of the current sheet.